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STUDENT TEAMS AND MASTERY LEARNING: A FACTORIAL EXPERIMENT IN URBAN MATH NINE CLASSES

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Introductory Statement

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Studies in School Desegregation program applies the basic theories of social organization of schools to study the internal conditions of desegregated schools, the feasibility of alternative desegregation policies, and the interrelations of school desegregation with other equity issues such as housing and job desegregation. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. It has produced a large-scale study of the effects of open schools, has developed Student Team Learning instructional processes for teaching various subjects in elementary and secondary schools, and has produced a computerized system for school-wide attendance monitoring. The School Process and Career Development program is studying transitions from high school to post-secondary institutions and the role of schooling in the development of career plans and the actualization of labor market outcomes. The Studies in Delinquency and School Environments program is examining the interaction of school environments, school experiences, and individual characteristics in relation to in-school and later-life delinquency.

The Center also supports a Fellowships in Education Research program that provides opportunities for talented young researchers to conduct and publish significant research, and to encourage the participation of women and minorities in research on education.

This report, prepared by the School Organization program, reports the results of a large-scale experimental study of Mastery Learning and Student Team Learning instructional methods.

Abstract

Mastery Learning and Student Team Learning are two widely used instructional methods designed to confront the problem of student diversity in group-paced instruction. This study evaluated Mastery Learning, Student Team Learning, and a combination, in 43 inner-city math nine classes over a full school year. Results indicated greater achievement on a standardized test for Team classes than non-Team classes, but no greater achievement in Mastery than non-Mastery classes. Differences in time use were suggested to explain treatment differences in student achievement.

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Introduction

Over the past several years, there has been growing interest among educational researchers in methods that seek to improve group-paced (as opposed to individualized) instruction. The question asked by this research is--given that many teachers teach the same material at the same rate to all their students, how can the effectiveness of this form of instruction be maximized? Improving group-paced instruction is especially important in junior and senior high schools, where individualization using either homogeneous reading or math groups, programmed instruction, or learning stations is rarely seen. In these schools, it is common practice for a single teacher to instruct a class of 25-35 students who may be quite diverse in background, aptitude, and motivation.

This diversity of student population creates several instructional design problems for the group-paced classrooms. First, instruction must be appropriately paced to meet the different needs of individual students. A fast instructional pace may leave behind students who are not catching on, and the cumulative effect of a fast pace may be especially deleterious in highly sequential subjects such as mathematics and reading in which students who fail to learn early skills have difficulty learning later ones (see Karweit, Note 1). On the other hand, a slow pace may hold back more able students and may reduce the interest of all students.

Another problem that student diversity creates for group-paced instruction is how to reward students for their efforts. In a heterogeneous classroom, good grades may be too easily available to some students and too inaccessible to others to serve as powerful motivators (see Slavin, 1978a).

Thus, student diversity poses critical problems for the pacing of instruction and for the incentive structure used in the classroom.

Three types of group-paced instructional methods have been extensively researched in recent years--Mastery Learning, Student Team Learning, and direct instruction learning models. Each deals with the inherent problems of group-paced instruction and student diversity in different ways. This paper describes each of these methods, reviews the literature related to its application, and reports the results of a year-long experimental study which implemented and evaluated variants of these group-paced instructional models.

Mastery Learning

Mastery Learning is the oldest and probably the most widely used systematic alternative to traditional group-paced instructional methods. Individualized methods, such as the Keller Plan, are often also referred to as Mastery Learning, but we are interested here in Mastery Learning as a group-paced strategy, following Block and Anderson's (1975) Mastery Learning in Classroom Instruction. Reduced to its essentials, group-paced Mastery Learning procedures involve the following teaching steps (from Block and Anderson, 1975, pp. 46-47).

1. Present the objectives.
2. Present the group-based instructional plan.
3. Present the group-based instruction.
4. Administer the diagnostic-progress ("formative") test.
5. Identify satisfactory/unsatisfactory progress in student learning (i.e., compare students' scores against a preset standard, such as 80% or 90% correct on the formative test).
6. Certify those students whose test performance is satisfactory (i.e., meets the preset standard).

7. "Correct" (reteach) those students whose performance is not satisfactory.

8. Monitor the effectiveness of the correction phase (i.e., assess students on a "summative" test).

9. Certify those students whose performance is now satisfactory (i.e., meets the preset standard on the summative test).

Mastery Learning thus confronts the problem of student diversity by providing additional corrective instruction to students who do not achieve a criterion score, or mastery, on a test tied to the unit objectives. Instead of holding time constant and letting learning vary as a consequence of individual differences, Mastery Learning holds learning to mastery constant, and allocates additional time to allow almost all students to meet that criterion. While students who did not achieve mastery on the formative test receive their corrective instruction, students who did achieve mastery work on parallel enrichment activities that do not advance them on the skills the class is studying.

Mastery Learning confronts the incentive problems of group-paced instruction (at least for low achievers) by making it possible for all students to receive a grade of "A" or "B" if they achieve mastery, regardless of how long it took them to do so. By thus allowing students enough time to master a topic, academic success is theoretically within the reach of every student.

Student Team Learning

A quite different approach to the problem of group-paced instruction is represented by Student Team Learning (Slavin, 1980a). In Student Team Learning methods, students are assigned to four- or five-member teams that are heterogeneous in student performance levels, sex, and race or ethnicity. There are several related Student Team Learning methods, but the simplest is Student Teams-Achievement Divisions, or STAD (Slavin, 1978b). In

classroom use, STAD involves the following steps:

1. The teacher presents the lesson (using lecture-discussion methods).
2. Students work in teams on worksheets to study the lesson.
3. Students take a quiz on the lesson.
4. Quiz scores are compared to students' past averages to compute improvement scores.
5. Team scores are formed from improvement scores, and highest-scoring teams are recognized in a class newsletter.

STAD confronts the instructional problem of student diversity in group-paced instruction by allowing students to work on their worksheets in heterogeneous learning teams. Students use the team study time both to learn the materials themselves and to make sure that their teammates have done so. While tutor-tutee roles are not assigned, the fact that the team members are heterogeneous in performance levels means that students who do not understand the concept being taught are likely to be able to learn the concepts from their peers. STAD units typically take about the same amount of class time as do units in traditionally structured classes, so STAD changes how instruction is delivered and studied rather than how time is allocated for students to learn.

STAD confronts the incentive problems of group-paced instruction by rewarding improvement rather than absolute level of performance. This system puts success and failure within the reach of every student, in contrast to the traditional grading system in which some students are much more likely to succeed than others (see Slavin, 1978a). The team score is designed to motivate students to help one another and to encourage one another to do well, and the improvement score system allows any student to contribute as much as any other to the team score.

Direct Instruction Components of Mastery and Student Team Learning

Another approach to designing a group-paced classroom is a set of principles collectively subsumed under the title "direct instruction" (Rosenshine and Berliner, 1977). The assumptions behind direct instruction are quite different from those behind Mastery Learning and Student Team Learning. Mastery Learning and Student Team Learning explicitly recognize student diversity as a problem to be solved in group-paced instruction; this is the central focus of Mastery Learning and to a lesser extent of Student Team Learning. The assumption guiding direct instruction methods is that group-paced instruction should be made more efficient, and that solutions to the general problems of group-paced instruction lie in well-established techniques, not in entirely new techniques such as Mastery Learning and Student Team Learning. Direct instructional methods or prescriptions vary widely, but agree on the centrality of such features as clear focus on instructional objectives, frequent assessment of student progress, high time-on-task, and rapid pace (see, for example, Good and Grouws, 1979).

Note that with the exception of rapid pace, the other features of direct instructional models appear in both Mastery Learning and Student Team Learning. These methods also emphasize clear focus on instructional objectives, frequent assessment (quizzes), and high time-on-task. Matery Learning inherently involves a slower pace, because it allocates class time to corrective instruction for students who need it. Student Team Learning does emphasize a rapid pace, but the varied activities involved in Student Team Learning typically require an overall instructional pace like that of the traditional classroom. However, it is still possible to see Mastery Learning and Student Team Learning as variations in

efficiency-oriented, objective-based direct instruction.

Given that Mastery Learning and Student Team Learning contain much of the instructional efficiency advocated by adherents of the direct instruction movement, it may be possible that if and when these methods are successful in increasing student achievement, they are successful because they incorporate and operationalize these elements, not because of their unique features (mastery criteria and corrective instruction for Mastery Learning; heterogeneous teams and improvement scores for Student Team Learning).

Research

The extent to which Mastery Learning significantly improves student achievement in elementary and secondary school is not completely clear. Although the effects of Mastery Learning on student achievement have been assessed in dozens of studies, few of these provide a fair test of Mastery Learning vs. traditional methods over a significant period. For example, some studies (e.g., Anderson, 1973, Note 2; Block, 1972, 1973; Fiel and Okely, 1974) took place over periods of one week or less. Many (e.g., Block, 1972, 1973; Fiel and Okey, 1974; Glasnapp, Poggio, and Ory, Note 3; Hymel and Gaines, Note 4; Jones, Note 5; Wentling, 1973) gave students corrective instruction outside of regular class time without providing any additional instruction for the control groups. In one study that measured this extra time (Wentling, 1973), it was found that the Mastery Learning classes received a total of 50% more instructional time than did control classes. A few studies (e.g., Caponigri, Matheis, and Schumann, Note 6) have even used grades as dependent variables, which is not legitimate, because grades are increased in Mastery Learning as part of the treatment.

Some evaluative research on Mastery Learning does not contain these flaws (see, for example, Okey, 1974, 1977; Hecht, Note 7). However, these studies share a more subtle problem. In each, a specific unit of study is given to Mastery Learning group(s) and control group(s). The different classes are held to the same schedule. This seems unbiased, but many studies (e.g., Wentling, 1973) show that traditional instruction takes less time to cover a unit than does Mastery Learning. If this is the case, holding both groups to the same schedule may artificially deprive the traditional control group of its advantage, especially when (as in these studies) a test based on the objectives taught in the Mastery clasees was used instead of a standardized test, so that any additional material taught in the traditional classes could not influence the final test score. Also, these studies are of short duration. The longest (Hecht, Note 7) covered three two-week units, while the Okey (1974, 1977) interventions were implemented for a total of only two weeks.

Two Mastery Learning studies in mathematics did allow the experimental and control groups to go at their own rates and evaluated the program over a long period. Kersh (Note 8) compared Mastery Learning to a control treatment in fifth grade mathematics classrooms for sixteen weeks. No differences on any of three achievement tests (including two standardized test scales) were found. Similarly, Anderson, Scott, and Hutlock (Note 9) compared Mastery Learning to a control treatment in grades 1-6 for a full year. Standardized test results indicated that Mastery classes significantly exceeded control classes on one of three subscales at grade 1, and on two of three subscales at grade 3. However, Non-Mastery classes significantly exceeded Mastery classes on all three subscales at grade 6. Results consistently favored the Mastery classes on a test composed of objectives taken directly from the Mastery curriculum; the authors admit that these

comparisons are more "content valid" for the Mastery groups than for the control groups. A retention test given three months after the end of the interventions was also based mostly on the objectives pursued in the Mastery classes. Thus, on tests that were not biased toward the Mastery classes, these longer studies that allowed the control groups to go at their own pace did not show advantages for Mastery Learning.

Although it is possible to find fault with one or another Mastery Learning study, the fact that many studies done in many different settings have found positive effects of Mastery Learning on student achievement cannot be completely discounted. There is still a need for studies of Mastery Learning that allow the Mastery and traditional groups to go at their own rates, so that coverage as well as degree of mastery are both allowed to vary. There is also a need to discover whether any effects of Mastery Learning are due to the use of Mastery criteria and corrective instruction, or due to the emphasis on clear objectives and frequent assessment that are characteristic of other group-paced models such as Student Team Learning and Direct Instruction.

Documentation of effects of Student Team Learning on student achievement is somewhat more straightforward, although there are still a few problems. Nineteen of the twenty-two field experiments evaluating Student Team Learning methods (STAD, TGT, and Jigsaw II) have found significantly positive effects on student achievement (see Slavin, in press). In all the Student Team Learning studies, experimental and control groups are given the same opportunity to learn a specified set of objectives, without any additional time or resources (other than teacher training) given to the experimental groups. Almost all studies of Student Team Learning involve time periods of at least six weeks, and all use standardized and/or curriculum-specific tests as dependent variables. In most studies

of Student Team Learning, the "control" group used a structured method called "focused instruction," in which the teacher presents a lesson, students work individually on worksheets, and then students take a quiz. Focused instruction thus contains the direct instructional components (e.g., clear focus on instructional objectives, frequent assessment) contained in Student Team Learning. Therefore, in such studies (e.g., Allen and Van Sickle, Note 10; Madden and Slavin, Note 11; Slavin, Note 12. 1981; Slavin and Oickle, 1981), the treatment effects on student achievement are clearly due to the use of the teams and the improvement scores. Focused instruction itself has been found to significantly improve student achievement (Slavin, 1980b; Beady, Slavin and Fennessey, 1981), and when Student Team Learning is compared to completely untreated control groups (not using focused instruction) achievement effects are also positive (e.g., Slavin and Karweit, 1981; Slavin, 1980b; also see DeVries and Slavin, 1978). One important problem, not addressed until this paper, is that none of the STL studies has lasted longer than a semester. It is important to find out if team motivation, a critical element of the treatment, diminishes with a longer period of time. Also, studies of Student Team Learning do not always find significantly positive effects on student achievement; a few studies (e.g., Slavin, 1978c, 1979) find no significant differences in achievement, although there is always a trend favoring the Student Team Learning group.

Study Design

The present study was designed to investigate the effects of Student Team Learning (STAD), Mastery, a combination of teams and Mastery, focused instruction, and an untreated control group on student achievement. This study compares these five treatments in a common design that allows instructional pace to vary but clearly specifies the instructional universe

that teachers are responsible for by providing all classes with the same book and associated objectives. The study took place in general mathematics (Math 9) classes in inner-city Philadelphia junior and senior high schools, and the teachers in each condition were trained by a school district staff development team experienced in all the methods. The research staff, except for behavioral observers who were not aware of the purpose of the study, had minimal involvement with program implementation after the initial training. This strategy avoided the possibility that extra attention or assistance of the researchers could affect the results. Thus, the treatments were implemented with minimal intervention, involvement, or supervision of the research staff. The experimental procedures were used over the entire school year to reduce the possibility that treatment effects would be due to novelty or to short-term motivation, and to allow all teachers an equal chance to cover the entire book on which the curriculum was based.

Teachers volunteered for the study and were randomly assigned to one of the five treatments by the research staff. Teachers could carry out their assigned treatment in more than one class if they so chose.

The experimental design allows for two sets of comparisons. One, a 2 x 2 factorial design, evaluates Mastery Learning and Teams as factors, with all treatments sharing the same curriculum materials and basic schedule (teaching-worksheet-quiz). This comparison permits assessment of the effects of Teams and Mastery Learning on achievement net of their focus on clear objectives and frequent assessment. The second set of comparisons involves contrasting each treatment with untreated control classes. These comparisons evaluate each method as a package rather than as a set of components.

Methods

The sample consisted of 1,487 ninth grade general mathematics students in 16 junior/senior high schools in inner-city Philadelphia. Of these students, 736 had usable pre- and post-test achievement data. This longitudinal sample is the basis of the analysis reported in this paper. Sample loss came about because of student absenteeism and mobility within the system. In addition, seven classes were deleted from the sample because fewer than five students in the class had usable pre- and post-tests. Thus the final sample consisted of 49 classrooms.

Although the sample loss is appreciable, it was roughly the same across all five treatments, falling in the range from 48 to 53 percent. Consequently, whatever factors lead to sample loss were probably equal across all treatments. We note also that a comparison of the achievement data of the cross-sectional samples with the longitudinal sample reveals the usual pattern of higher scores for the longitudinal than the cross-sectional sample.

Measures

A shortened version of the Mathematics Computations and Concepts and Application subscales of the Comprehensive Test of Basic Skills (CTBS), Level 2 Form S, and a curriculum specific test are the achievement measures used in this analysis. Every third item was taken from the CTBS in order to achieve a 30 item test which could be taken in one class period. The curriculum specific test was derived from items on the twenty-six worksheets. The raw number correct was used as the achievement measure for both the CTBS and the subject specific analyses.

Design and Treatments

The experimental design was a 2 x 2 factorial design, with Mastery

Learning and Teams as factors, plus an external untreated control group. The conditions are referred to as Mastery, Mastery and Teams, Teams, and focused instruction. These four treatments had both the curriculum materials and the schedule of instruction in common.

Curriculum

All four experimental treatments used the same curriculum materials. The curriculum consisted of 26 sets of worksheets and quizzes. The worksheets and quizzes were adapted from Mathematics for Today (Tobin, 1975), a Math 9 text that uses real-life problems to teach basic mathematical operations to low achieving students. The two Mastery treatments also received sets of enrichment activities, to be used by those students who had attained the mastery criterion on the formative test. These enrichment activities paralleled the worksheets and quizzes, but were made more difficult. The untreated control group received copies of the Tobin text but not the worksheets and quizzes.

Focused Schedule of Instruction

All treatments used a similar schedule of instruction that consisted of teacher lecture, worksheet work, and quizzes. This cycle usually took about one week to complete.

Treatments

Mastery (11 classes, 6 teachers). In the Mastery classes, the teaching of the units followed a prescribed sequence of teaching, individual worksheet work, formative quiz, corrective instruction, and summative quiz. The formative quiz was used to determine if students had achieved the 80% mastery criterion. Those who had not achieved mastery received corrective instruction, followed by a summative quiz. Those students who attained 80% or better on the formative quiz were provided enrichment activities pertaining to the same units.

Student Team Learning (8 classes, 6 teachers). In the team classes, the students followed a sequence of teaching, team study of the unit, and then a quiz on the unit. The quiz scores were compared to students' past averages, and their improvement scores were summed to form team scores. The highest scoring teams were recognized in a class newsletter. This procedure was identical to Student Team Achievement Divisions as designed by Slavin (1980c).

Teams and Mastery (8 classes, 6 teachers). These classes followed a sequence which combined elements of the Team treatment and Mastery treatment described above. In the Teams and Mastery treatment, the classes were taught using this sequence: teaching, team study, formative quiz, corrective instruction within teams, and summative quiz. Students who did not achieve the 80% mastery criterion on the formative test received corrective instruction within their teams. After corrective instruction, they took the summative quiz, and the teams' summative quiz scores were formed into team scores as in the Team treatment.

Focused Instruction (7 classes, 4 teachers). This treatment served as the control group in the factorial design. Classes used a schedule of instruction as follows: teaching, individual worksheet work, and quiz. This treatment thus differed from the Mastery treatment in that no corrective instruction or summative quiz was given. It differed from the Team treatment in that students worked individually and did not receive team recognition.

Untreated Control (15 classes, 10 teachers). Besides the four experimental conditions, an untreated control group was included for comparison purposes. This group received the same textbook on which the worksheets and quizzes were based, but did not receive the worksheets and quizzes. This group thus received instruction in the same material, but

their teachers used their normal instructional methods.

Results

Table 1 contains the results of the analyses of the standardized and subject curriculum specific achievement tests. In these analyses, the standardized pre-test was used as a covariate.

Table 1 About Here

The top panel of Table 1 provides the means and standard deviations for the pre- and post-tests. Examining the pre-test values for the control and experimental groups, it is apparent that the control group scored appreciably lower on the pre-test. Comparing the pre-test control group mean to the experimental treatment means, we found that the control group was significantly lower on the pre-test than the experimental groups ($F = 11.56$ $p < .001$). Thus, it appears that the control group departed substantially from what would be expected by random assignment. We could not locate any particular reason for this breakdown in randomization. Despite this difficulty we do use the control group in the following analyses, cautiously interpreting the results in light of these problems in randomization.

2 X 2 Comparisons

These analyses involve only the four experimental conditions. We carry out an analysis of covariance, controlling for the standardized pre-test, to determine the importance of the Mastery factor, the Team factor, and their interaction in explaining the post-test scores. The difficulty in randomization does not influence these results, as no statistically significant pre-test differences were found among the treatment groups in the 2 x 2 design. The middle panel of Table 1 provides the F values and relevant p's for the 2 x 2 comparisons. The team factor

classes had significantly higher standardized post-tests, net of pre-tests, than did non-Team classes ($F = 9.56$, $p < .01$). The Mastery factor and the interaction term were not significant for the standardized tests. The 2 x 2 comparisons involving the curriculum specific test did not indicate any significant differences.

Treatment vs. Control Comparisons

In these analyses, we compared each of the four experimental conditions (separately) with the untreated control group. In the discussion, we keep in mind the difficulties in randomization discussed earlier. For the standardized test, both the Mastery group and the focused instruction group differ significantly from the control group ($F = 9.23$, $p < .01$ for Mastery; $F = 5.95$, $p < .05$ for focused instruction). In both cases, the experimental conditions performed worse on the post-test, controlling on their initial score, than did the control group. The poor performance of the Mastery group in comparison to the control group is seen again on the curriculum-specific test ($F = 4.51$, $p < .05$). On this test, however, the focused instruction group did not differ from the control group. No significant differences were found for the Mastery and Teams or the Teams treatments. Again, given the apparent difficulties in randomization, these results must be interpreted tentatively, as we cannot determine the extent to which these differences arose due to treatment or due to uncontrolled factors.

Discussion

This study evaluated the achievement effects of a group-paced Mastery Learning model, Student Team Learning, a combination of the two, and a Focused Instruction model in a year-long implementation in math nine classes in inner-city Philadelphia. The factorial comparisons indicated that

classes that received the team treatment had significantly higher achievement on the standardized test, net of the pre-test score. No differences were found in the factorial comparisons for the subject-specific test. The comparisons with the untreated control group were made problematic due to significantly lower pre-test scores in the control group despite random assignment. The negative results for Mastery Learning and focused instruction and the lack of significantly positive results for Student Team Learning on both the standardized and subject-specific test must therefore be interpreted cautiously. It is impossible to determine the extent to which these findings are due to the treatment or due to pre-existing uncontrolled factors.

The lack of any positive evidence supporting Mastery Learning in either the 2 x 2 design or the treatment-control comparisons was not expected. Given the widespread belief in the efficacy of Mastery Learning for this type of student population, understanding in greater detail the reasons for the lack of effectiveness seems critical. We explore two additional hypotheses which could account for the lack of positive effects of Mastery Learning. One explanation involves the effect of a different pace of instruction. A second explanation involves the effect of treatment-by-ability interaction for the Mastery group.

Pacing Effects

A basic tenet of Mastery Learning is that most students can learn if they are given enough time to acquire the necessary skills. The uneven distribution of learning, according to this reasoning, results from students not having appropriate amounts of time for learning. As we pointed out in the review of Mastery Learning, many evaluations which have found positive effects for Mastery Learning have provided additional time. Thus,

it is plausible that Mastery Learning may require significantly more time to be successfully implemented. In our study, all treatments were given the same amount of time for mathematics instruction. Mastery Learning may have been successful at what it covered but, because it could require additional time, may have simply covered less material. If this were true, the Mastery treatment should have performed better on the test items on the early units that all classes were equally likely to have covered than on items from later units, which the Mastery classes may not have studied. To test this hypothesis, we divided the subject-specific test into three portions, corresponding to the time of year in which the items were taught. We then carried out separate analyses for these three tests to determine if the Mastery condition outperformed the other conditions on items covered at the beginning of the year. We did not find any evidence of differential achievement on any of these subtests.

A more direct way to examine whether there are significant differences in pace (and therefore coverage) is to examine teacher logs indicating the number of days spent on specific units. These logs provide only suggestive evidence, as they were not kept systematically by all teachers included in the achievement analysis. Comparing the log data for those who did complete them, we do not find that the Mastery treatment actually used, on average, substantially more time per unit than did the Mastery and Teams or the Student Team Learning treatment. However, the Mastery groups spent much more time taking tests than did the non-Mastery groups (26% of their instructional days vs. only 18% of instructional days in the non-Mastery classes). Thus, the Mastery classes covered units at about the same pace as the team classes, but they devoted less time to actual instruction. This difference in instructional time could, of

course, explain at least part of the failure of the Mastery treatment to increase student achievement.

Ability X Treatment Effects

Another explanation for the lack of positive effects for Mastery Learning was the possibility that Mastery Learning may be differentially effective for some students, particularly lower ability students. Such an effect would be consistent with the proposed uses of Mastery Learning in many situations where students are performing poorly. To see if this were true, we entered a treatment-by-ability interaction term and repeated the analyses reported in Table 1. These additional analyses indicated that there was not an ability x treatment interaction for the Mastery condition. However, we did find a significant ability x treatment interaction for the Student Team Learning treatment, indicating the positive effect of STL for students of low ability ($F = 4.35$, $p < .05$).

It is possible that implementation of the Mastery Learning treatments was less than optimal. Even the rudiments of Mastery instruction--testing and corrective instruction--were difficult to implement given the high absenteeism, high mobility and very low achievement of this population. Yet it is precisely this type of population for which Mastery Learning is seen as most applicable. Also, because this year-long implementation did not have a high involvement of the research staff in the day-to-day activities of the project, it seems to provide a fair assessment of how Mastery Learning would have been implemented under normal conditions in urban schools. In fact, the district training staff which trained the experimental teachers used essentially the same procedures it has used to train hundreds of Philadelphia teachers in Mastery Learning methods, and did visit classes several times over the course of the study to be sure

that teachers were implementing their treatments.

The findings of greater achievement on the part of the Team treatments is consistent with earlier research on Student Team Learning methods (Slavin, 1980a; Slavin, in press). This study is significant in the research on Student Team Learning for three reasons. First, it is the only evaluation of these methods which has taken place over a full academic year. The fact that signficant effects were found for this period of time is important, as it addresses the general applicability of these methods as a primary instructional mode in the classroom. Secondly, the study is important because it found that the addition of corrective instruction and summative quizzes did not enhance the effectiveness of the team learning approach. Third, this study provided additional evidence that Student Team Learning is particularly effective with low achievers. Previous pre-test by treatment interactions in the same direction have been found for STAD by Slavin (Note 12) and Slavin and Oickle (1981).

The conclusions of this study must be cautiously generalized. The students were very low achieving, inner-city students. There were severe problems with sample attrition due to high absenteeism, high mobility, and class changes within schools. Nonetheless, these conditions seem to be representative of urban school situations, and not defects of the study design. Similarly, the study was designed to involve a minimum amount of hand-holding from the researchers in an attempt to provide an evaluation of a project under conditions similar to what the schools themselves would experience outside of research. Thus, we see these results as applicable to many of the lower class, urban schools in which both Mastery Learning and Student Team Learning are often used.

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Table 1: Academic Achievement Results

Treatment Means and Standard Deviations

Test	Mastery N=156	Mastery and Teams N=125	Teams N=135	Focus N=138	Control N=182
Pretest CTBS	14.6 (5.5)	14.3 (4.7)	15.0 (6.2)	14.0 (4.5)	13.3 (6.0)
Posttest CTBS	16.1 (5.9)	17.1 (5.2)	17.6 (6.4)	15.9 (5.0)	16.6 (6.8)
Posttest CRT	8.1 (5.7)	9.9 (5.2)	9.8 (6.3)	9.7 (4.7)	8.9 (6.0)

F Values for 2 X 2 Factorial Comparison

	Mastery X Team	Team	Mastery
CTBS	.10 (d.f.=1,549)	9.56* (d.f.=1,550)	.14 (d.f.=1,550)
CRT	2.07 (d.f.=1,549)	1.05 (d.f.=1,550)	.96 (d.f.=1,550)

F Values for treatment control comparisons[a]

	Mastery vs Control	Mastery & Teams vs Control	Teams vs Control	Focus vs Control
CTBS	9.23** (d.f.=1,335)	.281 (d.f.=1,304)	.235 (d.f.=1,314)	5.95* (d.f.=1,317)
CRT	4.51* (d.f.=1,294)	.003 (d.f.=1,271)	.156 (d.f.=1,271)	.004 (d.f.=1,276)

* $P < .05$
** $P < .01$

[a]These comparisons should be interpreted with caution, as there were statistically significant differences between the control group and the experimental treatments.